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USSR INDUSTRIAL GAS MASKS

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Harmful gases and vapors often escape into the air of production departments of chemical plants. So that work may be carried out in such departments, appliances must be used which protect the respiratory organs of the individuals active there.

Protection of the respiratory organs from gases and vapors may be carried out by means of the filtration method, i.e., by adsorbing or absorbing the gas or vapor in the air with the aid of a suitable substance. Naturally, this method can only be used when the content of oxygen in the air is normal, i.e., when it amounts to 16-21%. When the oxygen content is lower, filtration is useless. Another method of protecting the respiratory organs is the isolation method, by means of which the respiratory organs can be either completely isolated from the outside air (oxygen inhalers) or protected from the air which is in the immediate vicinity of the location affected (the use of appliances equipped with tubing).

Appliances which bring about complete isolation are used mainly in cases where concentration of the gas or vapor in the air is not known. Soviet industry produces sufficient quantities of various appliances for individual protection of respiratory organs.

In appliances of the filter type (gas masks) for the resorption of gases and vapors, special substances having adsorptive and absorptive properties are used, i.e., activated carbon and various chemical absorbents (Kupramit, KhPSV, KhPA, UP-4, and others). Catalytic processes such as, for instance, the oxidation of carbon monoxide with the aid of hopcalite, are used rarely.

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To achieve protection against gases and vapors, industrial gas masks and, in some cases, civilian gas masks are used.

The canisters of industrial gas masks are of a standard type and have identical dimensions. They are distinguished by their color and markings, as shown in Table 1 [appended].

The canisters listed in Table 1 lack filters for protection against dust, smoke, and fog. Canisters which are equipped with filters have a white stripe along their casing. The canisters of industrial gas masks of all grades indicated, with the exception of grade CO, are effective until the odor of gas and vapor with which the air is contaminated is noticed by the wearer of the mask. When this odor is detected, one must replace the canister. Carbon monoxide is odorless, and for that reason, CO canisters are replaced when their weight is increased by 60 grams. If the weight is not indicated on the CO canisters that have been supplied, it is necessary to weight them and indicate the weight on their casing. During use, weighings are repeated, and the canister is considered ineffective when its weight rises by 60 grams. One of the characteristics of the CO canister is that it may become ineffective during storage in cupboards, where supplies to be used in case of accident are kept.

In operations during which not only gases and vapors, but also dust, is present in the air, one must use canisters provided with filters and marked with the letters BKF (a large box equipped with a filter). Canisters equipped with filters are supplied in the same grades as ordinary canisters.

In some types of chemical production, it is expedient to use a canister which has a larger capacity and presents less resistance to respiration. Canisters of this type bear the markings BOAMV.

They are of a larger size than the ordinary canister and are usually carried on the back of the wearer. Canisters of this type are supplied in all grades that have been listed in Table 1.

If the gas mask is used for only a short time, in cases where the concentration of gases and vapors is low, a large canister is inconvenient. In such cases, it is preferable to use the F-46 and R-2 respirators (see S. A. Toropov, Khimicheskaya Promyshlennost', No 3, page 177, 1954). In types of production where evolution of carbon monoxide is encountered, as for instance in gas-generator departments, one should, in addition to CO canisters, use the so-called self-saving devices.

The self-saving devices are gas masks which are effective for a short period of time only and are used for protection against carbon monoxide in cases where emergency breakdowns of machinery occur. The self-saving device is a hermetically-sealed appliance which is equipped with a small antigas canister, a mouthpiece, and a nose clamp. In the case of an accidental breakdown resulting in a sudden evolution of carbon monoxide, the canister of the self-saving device is opened and the device used for protection during a period of 30 minutes to one hour. Once the canister has been opened, it is no longer suitable for further use. The following grades of self-saving devices are supplied: for protection against carbon monoxide, SP-3 and SP-4, which can be used for 40 minutes, and grade SP-9, which can be used for about one hour; and for protection against sulphur dioxide and hydrogen sulphide, grade MKS, which can be used for 40 minutes. When a high concentration of the gas or vapor develops, for instance at the moment when the breakdown occurs, or whenever the oxygen content of the air is lower than 16%, appliances of the filter type, i.e., gas masks, cannot be of any use and one must resort to appliances of the isolating type.

Among the isolating types of appliances are oxygen devices, with the aid of which one may work, carry out salvage operations, and repair damage under conditions that are dangerous to human lives. The use of oxygen devices requires constant training and special selection, based on medical considerations, of persons who may be admitted to work involving the use of these devices. Characteristics of the more common oxygen devices are listed in Table 2 [appended].

A commonly used device of the isolating type is the appliance equipped with tubing. This type of appliance isolates the respiratory organs only from the air encountered in the immediate location where the person works. Devices equipped with tubing cannot be used when gases or vapors which act through the skin are present in the air, such as hydrogen cyanide. One should also not use appliances equipped with tubing in locations where there are many machines and other equipment and where the danger of entangling the tubing exists. Whenever devices equipped with tubing are used, the participation of two persons is required. Devices of the tube type consist of a mask or helmet, a tube which may be smooth or corrugated, and the funnel of a filter at the end of the tube, or an air blower which supplies air. Tube appliances may be of two types: the automatic-inspiration type and the air-supply type. At chemical-production establishments use is occasionally made of tube appliances of the automatic-inspiration type which are equipped with corrugated tubing. Gas-mask tubing is then used to provide the corrugated tube outlet. Such appliances of the tube type are usually made at the production establishment itself by the personnel of antigas stations or of some other units. The tube should not be longer than 8-9 meters, because corrugated tubing presents considerable resistance to respiration. Tubes made of corrugated tubing are easily damaged by a number of organic liquids, such as gasoline or crude petroleum, and by acids. One must constantly check the condition of the tubes. Industry supplies tube devices of good quality which are equipped with smooth tubing. Both the automatic-inspiration type and the air-supply type are available. Characteristics of the tube devices which are available are listed in Table 3 [appended].

Tube devices are often used in the cleaning of cisterns and wells, the repair of equipment, etc. Devices of the automatic-inspiration type must be thoroughly checked for tightness. Lack of tightness may result in inspiration of contaminated air. In devices of the air-supply type, this danger is eliminated, because an excess pressure of air always exists in the tube, so that contaminated air cannot enter. It does not follow from this that the tightness of tube appliances of the air-supply type should not be checked. One may always expect that the air supply will be interrupted and that the device will then have to be used as an automatic-inspiration appliance.

To select the correct type of protective device, one must know the content of oxygen in the air. When cleaning cisterns or tanks, one should not use an appliance of the filter type. Under conditions encountered in this type of work one may always expect high concentrations of gas and a low concentration of oxygen. Devices of the tube type should be used in such cases.

In evaluating the performance of the device, one must take into consideration the concentration of the gas or vapor and the type of operation.

Devices of the filtering and isolating type can be acquired from the following organizations:

1. Gas masks of all grades, PSh-1 and PSh-2 tube devices, self-saving devices, and F-46 and R-2 respirators from Glavkhimsnab [Main Administration of Chemical Supplies], Kpivokolennyy Pereulok No 12, Moscow;

2. Tube devices DPA-5 from the Rostov Technical School of Railroad Transportation, 90 Ulitsa Gor'kogo, Rostov-on-Don.

[Appended tables follow.]

Table 1. Canisters of Industrial Gas Masks

Marking	Color	Medium in Which Canister Gives Protection
A	Brown	Vapors of organic substances, chlorine, oxides of nitrogen
V	Yellow	Acidic gases, vapors of acids, sulfur dioxide, hydrogen chloride, oxides of nitrogen, hydrogen sulfide, hydrogen cyanide, etc.
G	Yellow-black	Mercury vapors
E	Black	Arsine, phosphine
K	Green	Ammonia
S	Blue	Sulfur dioxide
CO	White	Carbon monoxide
KD	Grey	Ammonia, hydrogen sulfide
M	Red	All gases and vapors (universal protection)
VK	--	Oxides of nitrogen, ammonia

Table 2. The Basic Characteristics of Oxygen Devices

Grade	Weight (in Kg)	How Device is Carried	Period During Which Device is Effective
KIP-5	7.5	On the side	1 hr
RKR-2	15.0	On the back	2 hr
RKK-1	7.0	On the side	2 hr

Table 3. The Basic Characteristics of Tube Devices

Name (grade)	Length of the Tube (in m)	Resistance to Respiration Which the Tube Offers (in mm of a water column)	Weight of the Tube (in kg)
PSh-1 manual	10	14-15	2-5
PSh-2 manual and automatic with air supply	20	6-9	24
DPA-5 automatic with air supply	50	(Corrugated tubing)	

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